The researches of General Tillo on temperature have led him to conclude that the continents are, as a whole, 3° cent. colder than the oceans between the latitudes of 90° N. and 50° S. The New Continent is 3° colder than the Old; and the Atlantic 2.6° colder than the Pacific. The northern hemisphere contains 14 per cent. of the cold regions, 35 per cent. of temperate, and 51 per cent. of hot regions. Dr. Supan's estimate, reached by a different method, gave 15, 32 and 53 per cent. for these regions.

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## GEOLOGY AND PALÆONTOLOGY.

THE VERTEBRATE FAUNA OF THE PUERCO EPOCH.—I have recently revised my material representing this fauna, and have added eighteen species to those already known. One of these belong to a new genus, viz.: Onychodectes, allied to Conoryctes (Creodont).

The Puerco formation lies on the Laramie in North Western New Mexico and South Western Colorado, and is largely covered by the Wasatch Eocene in both regions. It was discovered by the writer in 1874, at its eastern outcrop of about 500 feet thickness, and was identified by Endlich and Holmes in Colorado, in 1876, where the thickness reaches 1000 to 1200 feet. On the San Juan river, its thickness is 700 feet, while at its western outcrop, south of that river, its thickness is 800 or 900 feet. While the formation possesses lithological peculiarities, no clue to its importance in geologic chronology was known until the discovery of vertebrate remains was made in 1880, by Mr. David Baldwin. With the evidence derived from this material the writer has been able to interject into the series of epochs of geological time a period which must have possessed many peculiarities, and which differed in such important essentials from those which preceded and from those that followed it, that an immense interval between them is proved to have existed, such as had not been previously suspected. The rich fauna which it contains displays characters which indicate others yet to be discovered before connections with other epochs both prior and subsequent can be known.

The vertebrate fauna includes up to the present date one hundred and six known species. Four species of Mollusca have been discovered, which have been determined by Dr. C. A. White, of the U. S. National Museum. They are *Unio rectoides* White; *Helix adipis* White; *H. nacimientensis* White, and *Pupa leidyi* Meek. The first named is found in the Wasatch, and the last in the Laramie; the two other species are peculiar. Besides these, the only other indications of organic life at that period is petrified wood of undetermined trees, which is quite abundant.

The character of the vertebrate fauna is indicated by the following table:

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| Reptilia | 12 | Bunotheria | 52 |
| Crocodilia | 3 | Tæniodonta | 3 |
| Testudinata | 5 | Creodonta | 49 |
| Rhynchocephalia | 3 | Taxeopoda | 28 |
| Ophidia | 1 | Quadrumana | 4 |
| Aves | 1 | Condylarthra | 24 |
| Mammalia | 93 | Amblypoda | 2 |
| Marsupialia | 11 | Total | 106 |

In 1874, the writer advanced the proposition that the ancestors of modern placental mammalia would be found to be "plantigrade pentadactyle bunodonts." This anticipation was partly realised in the fauna of the Wasatch epoch subsequently discovered, but is completely so, in the characters of the mammalia of the Puerco epoch. All the placentals, and probably the Implacentals also, were "plantigrade pentodactyle bunodonts." More than this, the placentals nearly all present the primitive type of dendition of the maxillary series, since the superior no less are nearly all of the tritubercular type. But four species out of the eighty-seven placentals are quadritubercular. In the inferior molars the tuberculosectorial, or quinquetubercular type of dertition is extensively prevalent, but not so generally so as the superior tritubercular. Thus of the eighty-seven placentals sixty-four present the primitive type.

In its relations to other faunæ, the Puerco is totally distinct as to species. No species comes to it from an earlier epoch, and none continued unchanged after it. Of genera not widely distributed in time, one of lizard-like Rhynchocephalia, Champsosaurus, comes over from the Laramie, with a genus of tortoises Compsemys. Another genus of tortoises, Dermatemys, probably commences at this epoch, to continue through the Wasatch and Bridger Eocenes to the present time, since it still exists in Mexico. Among Mammalia, one genus only continues later, since Didymictis is found in the Wasatch and Wind-river formations. None other continues after the close of the Puerco. Not only this, but the entire family of the Periptychidæ ceased at that period. The same is true of the Amblypod family Pantolambdidæ. One of the most important features of. the fauna is, however, the presence of eleven species of the Marsuspialia Multituberculata, a suborder which commenced in the Triassic age, and which terminated its existence so far as the Northern Hemisphere is concerned, with the end of the Puerco epoch. This series of animals gives a Mesozoic character to the fauna, which is not necessarily counterbalanced by the characters of the remaining types. The placentals are in all probability those which existed during the latter part of Mesozoic time, and the absence of some of the forms of the Eocene increases the weight of the impression thus produced. Thus two orders

universally present in the Eocenes, the Perissodactyla and the Rodentia, are wanting from the Puerco.

In conclusion it may be safely assumed that in the Puerco fauna, we find the ancestors of the species of Eocene and of later times. In the Tæniodonta we get ancestors of Tillodonta and probably of Rodentia and Edentata. In Creodonta we get the ancestors of the Carnivora, in the family of the Miacidæ. In the Condylarthra, we get the ancestors of the Diplarthra and Amblypoda, and in the Puerco Amblypoda the ancestors of those of the following epochs. Hence the investigation of this fauna possesses an especial interest for the mammalogist and for the evolutionist, as well as for the geologist proper.—*E. D. Cope.*

SCHLOSSER ON THE CÆNOZOIC MARSUPIALS AND UNGUICULATA.[1]—The first part of this work contains all of the Unguiculata, except the Edentata, Rodentia and Carnivora. The last-named order will form the second part. The work is an important one, in quarto form, and the first part is illustrated with five plates. This supplements the American works on the same subject and brings it up to the present time, with minor exceptions.

The present author shows throughout, his fine appreciation of the points of structure of the vertebrate skeleton, and he makes judicious use of them, from a systematic point of view, although one observes, perhaps, a tendency to rather more minute taxonomic division than the circumstances warrant. The work is also characterized by a thorough acquaintance with the literature of the subject. Important additions to our knowledge are made in every department.

We can only mention here the descriptions of the little-known genera of Von Meyer—Dimylus, Cordylodon and Oxygomphius, the first two remarkable forms of Insectivora. To the Creodonta he adds the new genus Pseudopterodon, which is founded on a species of about the size of a fox (*P. ganodus*), allied to Pterodon.

Dr. Schlosser continues to exclude the Miacidæ from the Creodonta; but he has not been aware that Scott shows that the lumbar zygapophyses have the characters of the other members of that order or sub-order. For some unaccountable reason he places Esthonyx in the Edentata. Numerous important additions are made to the Chiroptera, in the genera Vespertiliavus and Pseudorhinolophus.

One of the most striking discoveries recorded is the fact that the supposed canine teeth of the Lemurs of the present period are really the anterior premolars, as in the Artiodactyle genus Oreo-

[1] Die Affen, Lemuren, Chiropteren, Insectivoren, Marsupialier, Creodonten u. Carnivoren d. europäischen Tertiärs, von Max Schlosser. I Theil. Alfred Hölder. Wien, 1887.

don. This obvious fact has, curiously, escaped the observation of all the numerous naturalists who have studied this group. As a consequence, he separates the eocene forms, which have all true canines in the lower jaw, as a distinct sub-order—the Pseudolemuridæ. Should this be really a sub-order, the name Mesodonta would have been the proper one to employ; but if a family only, then the term Adapidæ is applicable—which is, indeed, used by Dr. Schlosser in a restricted sense. Most of Dr. Schlosser's new material is derived from the French phosphorites.

We congratulate the author on the fact that no person can study this subject henceforth without the aid of this memoir.

LYDEKKER'S CATALOGUE OF FOSSIL MAMMALIA IN THE BRITISH MUSEUM, PART V.[1]—We have in this part of Dr. Lydekker's Catalogue a valuable contribution to the subject of which it treats. The light thrown on questions of affinity and taxonomic usage is considerable, and supplements from a conservative stand-point the opposite tendencies of Dr. Schlosser. Our own view of the case leads us to adopt in most cases the *aurea mediocritas* between these two distinguished cultivators of the science. There is one point, however, in which we are compelled to agree with Schlosser and not with Lydekker, and this in a question of scientific purism of which the latter is in all other cases so able a defender. This is in the matter of requiring a description,—whether good or bad matters not as to the rule,—for a genus and other division above species, as an essential basis for a nomenclature. *E. g.*, in the "Catalogue" we find the name Platychœrops used instead of Miolophus, although no reason for the separation of the former was ever given by its describer. Perhaps no description was given to Miolophus either. In that case Dr. Lydekker has the right to select whichever name he prefers, or to give a new one. One other point. On page 161, under the genus *Nototherium* Owen, we read, "Since this is the only known genus, its characters are the same as those of the family." Now, no one knows better than the author of this excellent series of works, that this cannot be the case!

Of course it is impossible for an author to keep pace with rapid additions to knowledge made in other countries. We only call attention here to the additional definitions of the Creodonta to be found in Professor Scott's late memoir on that order, and refer to my own later studies, now in press, on the fauna of the Puerco Epoch. But we object to the slight value attached by Dr. Lydekker to the presence or absence of the scapholunar bone in this order (p. 305). Finally, we rise to two questions

[1] Catalogue of Fossil Mammalia in the British Museum, Part V., containing Tillodontia, Sirenia, Cetacea, Edentata, Marsupialia, Monotremata, and Supplement. By Richard Lydekker, B.A., F.G.S., etc. London. 1887.

of privilege. The first point is found in a foot-note on page one, viz.: "Cope (*Vert. of the Tertiaries*, p. 195), who regards the outermost cutting-tooth as an incisor, states that it is absent in Tillotherium and present in Anchippodus, and that in the former there are seven and in the latter six cheek-teeth." This paragraph commits me to two errors of which I am not guilty. Let "outermost cutting-teeth" be changed into *innermost* cutting-teeth, and I am correctly quoted. As to the cheek-teeth, I state that my information as to Tillotherium is derived from Marsh, and as to Anchippodus I give the number with a question. The second point I wish to refer to is the assertion in a foot-note on page 379, that I state "that the inflection (of the mandibular angle) is absent in European forms" (of Peratherium). I here referred to the species called Oxygomphius by Von Meyer, some of which are true marsupials, but others are, according to Schlosser, Talpidæ. If there be an error, it is that of Von Meyer.—*E. D. Cope.*

GEOLOGICAL NEWS—GENERAL.—The "American Geologist" sends forth its first issue in January, 1888. It announced that it is to be a non-partisan publication, open to the properly-worded opinions of all, from the most powerful to the most obscure, and "committed to no theory whether of construction or obstruction." Its editors and proprietors are Profs. S. Calvin, of Iowa University; E. W. Claypole, of Buchtel College; A. E. Hicks, of Nebraska State University; N. H. Winchell, of Minnesota University; Dr. Persifor Frazer, of Philadelphia; Dr. A. Winchell, of Michigan University; and Mr. L. O. Ulrich, of the Geological Survey of Illinois.

Prof. Claypole utters (*American Geologist*) a most distinct warning to those who, merely because the wish is father to the thought, believe the supply of natural gas to be inexhaustible. Natural gas, oil, and salt-water are geologically connected, and, where the strata are arched upwards, usually collect in the order named. After a certain part of the gas has been drawn off the oil will rise, and lastly the brine. Many once productive oil-wells are now little more than brine wells, though their age is but twenty years.

Gregorio Stefanescu, chief of the Geological Survey of Roumania, has issued a geological atlas of that country in fourteen colored sheets. Diluvial and alluvial strata are largely developed, but crystalline rocks occupy the northern portion bordering on Transylvania.

SILURIAN.—Messrs. U. P. and J. F. James publish in the *Journal* of the Cincinnati Society of Natural History a revision of

the species of the Monticuliporoid corals of the Hudson River group. They admit two genera, Monticulipora and Ceramopora, the former with the sub-genera Dekayia, Constellaria and Fistulipora.

DEVONIAN.—Prof. Calvin (*American Geologist*) describes *Streptindytes acervulariæ*, a new species and genus of tubicolar Annelida from strata of the Hamilton period, at Robert's Ferry, Iowa.

CARBONIFEROUS.—Dr. G. J. Hinde, in a paper read before the British Association at Manchester, brings evidence in support of the organic origin of the "chert" in the carboniferous limestone series of the British Isles. He believes that the Irish cherts at least are derived from the accumulation of the skeletal elements of the siliceous sponges.

JURASSIC.—Prof. H. G. Seeley has shown, by superimposing a figure of the reputed clavicle upon the bone figured by Mr. Hulke as clavicle and interclavicle of Iguanodon (*Quart Journ. Geol. Soc.*, vol. xli. pl. xiv.) that the supposed sutures are fractures, and that the supposed interclavicle has no existence, except as an ossification posterior to the reputed clavicles. Prof. Seeley urges the analogy of these bones with the reputed pubes of crocodiles, and concludes that they are pre-pelvic.

Prof. Seeley concludes, from examination of fœtal Plesiosauri found in a phosphatized nodule of Lias, that the Plesiosaurus was viviparous, and that the species in question, probably *P. homospondylus*, produced many young at a birth.

TERTIARY.—R. Lydekker (*Geol. Mag.*, July, 1887) states that all the so-called fossil Alligators of the Old World really belong to the genus Diplocynodon, and since the crocodiles (C. *palustris* and C. *sivalensis*) which approach nearest to this genus in the structure of the cranium and form of the maxillo-premaxillary suture on the palate are confined to India, it becomes interesting to know whether the existing alligator recently described from China, may not show signs of affinity with Diplocynodon.

Mr. Lydekker concludes that *Crocodilus champsoides* and C. *toliapicus*, from the London clay, are but the young and old individuals of a single species, for which the original name of C. *spenceri* Buckland, should be retained.

H. B. Geinitz identifies *Nautilus alabamensis* Morton, and *N. lingulatus* von Buch with *Nautilus ziczag* Sowerby, and places the form in the genus Aturia. The species is from the Tertiary of Alabama and Mississippi.